CLAIMS:

1. A method of establishing wireless communications between an interrogator and individual ones of multiple wireless identification devices, the method comprising utilizing a tree search method to establish communications without collision between the interrogator and individual ones of the multiple wireless identification devices, a search tree being defined for the tree search method, the tree having multiple levels respectively representing subgroups of the multiple wireless identification devices, the method further comprising starting the tree search at a selectable level of the search tree.

2. A method in accordance with claim 1 and further comprising determining the maximum possible number of wireless identification devices that could communicate with the interrogator, and selecting a level of the search tree based on the determined maximum possible number of wireless identification devices that could communicate with the interrogator.

3. A method in accordance with claim 2 and further comprising starting the tree search at a level determined by taking the base two logarithm of the determined maximum possible number, wherein the level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively.

4. A method in accordance with claim 2 and further comprising starting the tree search at a level determined by taking the base two logarithm of the determined maximum possible number, wherein the level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

5. A method in accordance with claim 2 and further comprising starting the tree search at a level determined by taking the base two logarithm of the power of two nearest the determined maximum possible number, wherein the level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

6. A method in accordance with claim 1 wherein the wireless identification device comprises an integrated circuit including a receiver, a modulator, and a microprocessor in communication with the receiver and modulator.

7. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices, the method comprising:

establishing a first predetermined number of bits to be used as unique identification numbers, and establishing for respective devices unique identification numbers respectively having the first predetermined number of bits;

establishing a second predetermined number of bits to be used for random values;

causing the devices to select random values, wherein respective devices choose random values independently of random values selected by the other devices;

determining the maximum number of devices potentially capable of responding to the interrogator;

transmitting a command from the interrogator requesting devices having random values within a specified group of random values to respond, the specified group being chosen in response to the determined maximum number;

receiving the command at multiple devices, devices receiving the command respectively determining if the random value chosen by the device falls within the specified group and, if so, sending a reply to the interrogator; and

determining using the interrogator if a collision occurred between devices that sent a reply and, if so, creating a new, smaller, specified group.

8. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 7 wherein sending a reply to the interrogator comprises transmitting the unique identification number of the device sending the reply.

9. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 7 wherein sending a reply to the interrogator comprises transmitting the random value of the device sending the reply.

10. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 7 wherein sending a reply to the interrogator comprises transmitting both the random value of the device sending the reply and the unique identification number of the device sending the reply.

11. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 7 wherein, after receiving a reply without collision from a device, the interrogator sends a command individually addressed to that device.

12. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices, the method comprising:

establishing unique identification numbers for respective devices;

causing the devices to select random values, wherein respective devices choose random values independently of random values selected by the other devices;

transmitting a command from the interrogator requesting devices having random values within a specified group of a plurality of possible groups of random values to respond, the specified group being less than the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on the tree selected based on the maximum number of devices capable of communicating with the interrogator;

receiving the command at multiple devices, devices receiving the command respectively determining if the random value chosen by the device falls within the specified group and, if so, sending a reply to the interrogator; and, if not, not sending a reply; and

determining using the interrogator if a collision occurred between devices that sent a reply and, if so, creating a new, smaller, specified group by descending in the tree.

13. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 12 wherein establishing unique identification numbers for respective devices comprises establishing a predetermined number of bits to be used for the unique identification numbers.

14. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 13 and further including establishing a predetermined number of bits to be used for the random values.

15. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 14 wherein the predetermined number of bits to be used for the random values comprises an integer multiple of eight.

16. A method of addressing messages from an interrogator to a selected one or more of a number of communications devices in accordance with claim 14 wherein devices sending a reply to the interrogator do so within a randomly selected time slot of a number of slots.

17. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices, the method comprising:

establishing for respective devices unique identification numbers respectively having a first predetermined number of bits, the first predetermined number being a multiple of sixteen;

establishing a second predetermined number of bits to be used for random values, the second predetermined number being a multiple of sixteen;

causing the devices to select random values, wherein respective devices choose random values independently of random values selected by the other devices;

transmitting a command from the interrogator requesting devices having random values within a specified group of a plurality of possible groups of random values to respond, the specified group being equal to or less than the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the maximum size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on a level of the tree selected based on the maximum number of devices known to be capable of communicating with the interrogator;

receiving the command at multiple devices, devices receiving the command respectively determining if the random value chosen by the device falls within the specified group and, only if so, sending a reply to the interrogator, wherein sending a reply to the interrogator comprises transmitting

both the random value of the device sending the reply and the unique identification number of the device sending the reply;

using the interrogator to determine if a collision occurred between devices that sent a reply and, if so, creating a new, smaller, specified group using a level of the tree different from the level used in the interrogator transmitting, the interrogator transmitting a command requesting devices having random values within the new specified group of random values to respond; and

if a reply without collision is received from a device, the interrogator subsequently sending a command individually addressed to that device.

18. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 and further comprising determining the maximum possible number of wireless identification devices that could communicate with the interrogator.

19. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 wherein selecting the level of the tree comprises taking the base two logarithm of the determined maximum possible number, wherein a level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively.

20. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 wherein selecting the level of the tree comprises taking the base two logarithm of the determined maximum possible number, wherein a level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

21. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 wherein selecting the level of the tree comprises taking the base two logarithm of the power of two nearest the determined maximum possible number, wherein the level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

22. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 wherein the wireless identification device comprises an integrated circuit including a receiver, a modulator, and a microprocessor in communication with the receiver and modulator.

23. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 wherein the first predetermined number of bits is sixteen.

24. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 and further comprising, after the interrogator transmits a command requesting devices having random values within the new specified group of random values to respond:

devices receiving the command respectively determining if their chosen random values fall within the new smaller specified group and, if so, sending a reply to the interrogator.

25. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 24 and further comprising, after the interrogator transmits a command requesting devices having random values within the new specified group of random values to respond:

determining if a collision occurred between devices that sent a reply and, if so, creating a new specified group and repeating the transmitting of the command requesting devices having random values within a specified group of random values to respond using different specified groups until all of the devices within communications range are identified.

26. A communications system comprising an interrogator, and a plurality of wireless identification devices configured to communicate with the interrogator in a wireless fashion, the respective wireless identification devices having a unique identification number, the interrogator being configured to employ a tree search technique to determine the unique identification numbers of the different wireless identification devices so as to be able to establish communications between the interrogator and individual ones of the multiple wireless identification devices without collision by multiple wireless identification devices attempting to respond to the interrogator at the same time, wherein the interrogator is configured to start the tree search at a selectable level of the search tree.

27. A communications system in accordance with claim 26 wherein the tree search technique is a binary tree search technique.

28. A communications system in accordance with claim 26 wherein the wireless identification device comprises an integrated circuit including a receiver, a modulator, and a microprocessor in communication with the receiver and modulator.

29. A system comprising:

an interrogator;

a number of communications devices capable of wireless communications with the interrogator;

means for establishing a first predetermined number of bits to be used as unique identification numbers, and for establishing for respective devices unique identification numbers respectively having the first predetermined number of bits;

means for establishing a second predetermined number of bits to be used for random values;

means for causing the devices to select random values, wherein respective devices choose random values independently of random values selected by the other devices;

means for inputting a predetermined number indicative of the maximum number of devices possibly capable of communicating with the receiver;

means for causing the interrogator to transmit a command requesting devices having random values within a specified group of random values to respond, the specified group being chosen in response to the predetermined number;

means for causing devices receiving the command to determine if their chosen random values fall within the specified group and, if so, send a reply to the interrogator; and

means for causing the interrogator to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified group.

30. A system in accordance with claim 29 wherein sending a reply to the interrogator comprises transmitting the unique identification number of the device sending the reply.

31. A system in accordance with claim 29 wherein sending a reply to the interrogator comprises transmitting the random value of the device sending the reply.

32. A system in accordance with claim 29 wherein sending a reply to the interrogator comprises transmitting both the random value of the device sending the reply and the unique identification number of the device sending the reply.

33. A system in accordance with claim 29 wherein the interrogator further includes means for, after receiving a reply without collision from a device, sending a command individually addressed to that device.

34. A system comprising:

an interrogator configured to communicate to a selected one or more of a number of communications devices;

a plurality of communications devices;

the devices being configured to select random values, wherein respective devices choose random values independently of random values selected by the other devices;

the interrogator being configured to transmit a command requesting devices having random values within a specified group of a plurality of possible groups of random values to respond, the specified group being less than the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on the tree selected based on a predetermined maximum number of devices capable of communicating with the interrogator;

devices receiving the command being configured to respectively determine if their chosen random values fall within the specified group and, if so, send a reply to the interrogator; and, if not, not send a reply; and

the interrogator being configured to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified group by descending in the tree.

35. A system in accordance with claim 34 wherein the random values respectively have a predetermined number of bits.

36. A system in accordance with claim 34 wherein respective devices are configured to store unique identification numbers of a predetermined number of bits.

37. A system in accordance with claim 34 wherein respective devices are configured to store unique identification numbers of sixteen bits.

38. A system comprising:

an interrogator configured to communicate to a selected one or more of a number of RFID devices;

a plurality of RFID devices, respective devices being configured to store unique identification numbers respectively having a first predetermined number of bits, the first predetermined number being an integer multiple of sixteen, respective devices being further configured to store a second predetermined number of bits to be used for random values, the second predetermined number being an integer multiple of sixteen, respective devices being configured to select random values independently of random values selected by the other devices;

the interrogator being configured to transmit an identify command requesting a response from devices having random values within a specified group of a plurality of possible groups or random values, the specified group being less than or equal to the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the maximum size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on a level of the tree selected based on a predetermined number based on the maximum number of devices known to be capable of communicating with the interrogator;

devices receiving the command respectively being configured to determine if their chosen random values fall within the specified group and, only if so, send a reply to the interrogator, wherein sending a reply to the

interrogator comprises transmitting both the random value of the device sending the reply and the unique identification number of the device sending the reply;

the interrogator being configured to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified group using a level of the tree different from the level used in previously transmitting an identify command, the interrogator transmitting an identify command requesting devices having random values within the new specified group of random values to respond; and

the interrogator being configured to send a command individually addressed to a device after communicating with a device without a collision.

39. A system in accordance with claim 38 wherein the interrogator is configured to input and store the predetermined number.

40. A system in accordance with claim 38 wherein the devices are configured to respectively determine if their chosen random values fall within a specified group and, if so, send a reply, upon receiving respective identify commands.

41. A system in accordance with claim 40 wherein the interrogator is configured to determine if a collision occurred between devices that sent a reply in response to respective identify commands and, if so, create further new specified groups and repeat the transmitting of the identify command requesting devices having random values within a specified group of random values to respond using different specified groups until all responding devices are identified.

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